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Indian Standard

GENERAL REQUIREMENTS FOR INSULATION IN AIR-CONDITIONED SPACES ON BOARD SHIPS

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GENERAL REQUIREMENTS FOR INSULATION IN AIR-CONDITIONED SPACES ON BOARD SHIPS

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Indian Standard

GENERAL REQUIREMENTS FOR INSULATION IN AIR-CONDITIONED SPACES ON BOARD SHIPS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 March 1979, after the draft finalized by the Shipbuilding Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 Effective application of insulation is important in ships for the following reasons:

- a) It decreases heat load by limiting heat transmission and thus resulting in a more economical plant;
- b) Maintaining the desired comfortable temperature conditions in living spaces;
- c) Preventing moisture condensation which may cause damage to the material in contact and in addition by creating high humidity ambients which indirectly cause deterioration of structures and materials;
- d) Reducing fire hazards and preventing fire from spreading to adjacent spaces; and
- e) It reduces noise levels also in the cabins.

1. SCOPE

1.1 This standard covers guidelines for selection of insulation material to be used in air-conditioned spaces on board ships.

2. GENERAL REQUIREMENTS

2.1 Thermal Conductivity — The heat transmission coefficient (U -values) in ships accommodation are such higher compared to land-based buildings. Hence it is important to use insulation having low thermal conductivity which shall permit the use of lower thickness to achieve a particular temperature gradient, thus allowing more effective use

of the ship's space. The *U*-values given in IS : 8649 (Part I)-1977* shall be the guiding factor for this purpose.

2.2 Fire Resistance — Bulkheads and decks of the fire resisting zone shall be provided with insulation of approved non-combustible type, as specified.

2.3 Moisture Absorption — The thermal conductivity of the insulation rises rapidly with the absorption of moisture. Insulation shall, therefore, have a low moisture absorption characteristic.

2.3.1 If the insulation is placed on a cold surface, the vapour passing through the insulation condenses on the cold surface. To prevent this vapour seals may be provided on the warm side of the insulation.

2.4 Resistance to Corrosion — The insulating material shall not cause or accelerate corrosion of the ships' material. It shall also be resistant to and shall not deteriorate under the effect of saline atmosphere and sulphurous exhaust gases from the ships' stack.

2.5 Density — The density of insulation material is important for ships and the same should be taken into consideration at the design stage.

2.6 Resistance to Vibration, Settling, Rolling and Pitching — It is necessary that settling of insulation material which may be caused due to the severe ship motion and vibration does not lead to the formation of empty pockets. Hence use of insulation in slab form is recommended.

2.7 Sound Absorption — The insulating material shall have good sound absorption quality. In a ship, noise is generated from various equipment, like, air-conditioning plant, ventilation plant and other machinery. In order to provide comfortable living and working environments, noise level in the accommodation space should be limited to N 50 (ISO noise rating number).

2.8 Other Qualities — Other desirable properties for insulation material should be as follows:

- a) Vermin proofness;
- b) Compressibility, flexibility to suit ships' curvature;
- c) Durability;
- d) Low health hazard; and
- e) Freedom from obnoxious fumes.

2.8.1 General properties of some of the insulation materials are given in Appendix A for comparison purposes.

*Procedure for designing the air-conditioning system on board ships: Part I Heat load calculation.

APPENDIX A

(Clause 2.8.1)

PROPERTIES OF INSULATION MATERIALS

<i>Insulating Material</i>	<i>Mineral Wool</i>	<i>Glass Wool</i>	<i>Asbestos Sprayed</i>
Bulk density, kg/m ³	12-50 up to maximum hot face temperature of 250°C	130 under a load of 0.01 kg/cm ²	—
Coefficient of thermal conductivity at mean temperature of 50°C	0.49 mW/cm °C	0.43 mW/cm °C	0.58 mW/cm °C
Usable temperature range	— 50 to 700°C	— 195 to 550°C	—
Fire risk	None	None	None
Convection resistance	Little	Little	Good
Odour emission	None	None	None
Resistance to micro-organisms	Complete	Complete	Complete
Resistance to rodents	Very good	Very good	Good
Sound absorption and insulation	Good	Good	Good
Resistance to vibration	Very good	Very good	Good
Alkalinity (pH value)	7-10	7-10	—
Relevant Indian Standard	IS : 8183-1976* IS : 3144-1965†	IS : 3690-1974‡ IS : 3144-1965†	—

*Specification for bonded mineral wool.

†Methods of test for mineral wool thermal insulation materials.

‡Specification for unbonded glass wool mats for thermal insulation (first revision).

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N = 1 kg. m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²